

# PATENT ABSTRACTS OF JAPAN

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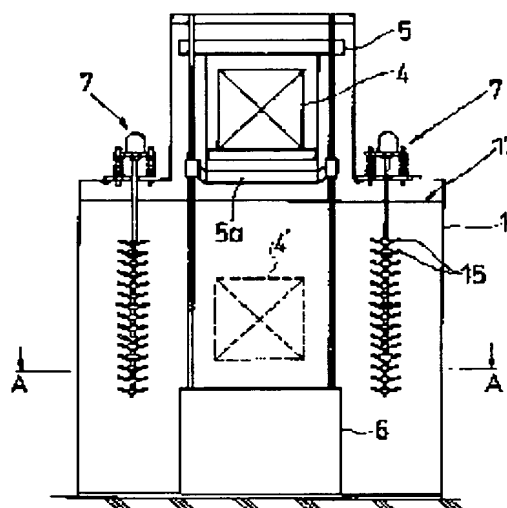
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## (54) QUENCHING APPARATUS

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To execute the quenching without developing the unevenness by removing steam film developed so as to cover a work as soon as possible when the heated work is dipped into quenching agent.

**SOLUTION:** The work is laid on a tray 4 and disposed to a prescribed quenching position 4' of a quenching vessel 1. At the position surrounding the prescribed quenching position 4', a vibration generating means 7 is arranged. The vibration generating means 7 has plural blades 15 vertically vibrated. The flexible blades 15 directly stir the quenching agent while bending in the quenching agent like a fan so as to develop the transverse vibration in the quenching agent. The transverse vibration (10-120 Hz) developed in the quenching agent is propagated to the prescribed quenching position 4' through the quenching agent. Since the vibrating wave is composed mainly of the transverse vibration (at least not the vibrating wave only in the vertical direction but the three dimensional wave), the steam film on the upper and the lower surfaces of the work laid on the tray 4 in the horizontal direction almost uniformly is removed.



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**CLAIMS**

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[Claim(s)]

[Claim 1] Quenching equipment characterized by carrying a hardening agent and having an oscillating generating means to make the oscillatory wave of a direction which removes a wrap steam film for a work piece efficiently spread, to the work piece arranged in the predetermined location in a quenching tub.

[Claim 2] Quenching equipment according to claim 1 which sets vibration frequency of said oscillatory wave to ten to 120 Hz.

[Claim 3] Said vibration generator system is quenching equipment according to claim 1 or 2 which is the thing which makes the both-way oscillation of two or more wings aligned within said quenching tub so that it might pile up carry out in the alignment direction concerned.

[Claim 4] Said two or more wings are quenching equipment of a publication of claim 3 characterized by driving with the vibrating motor by which it is fixed to the oscillating shaft prolonged in the vertical direction within said quenching tub, and the upper bed section of this oscillating shaft was fixed above the quenching tub.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] In case this invention feeds the heated work piece into a hardening agent, it removes the steam film generated so that a work piece may be covered as soon as possible, and relates to the quenching equipment for performing quenching without dispersion.

[0002]

[Description of the Prior Art] Quenching is actuation hardened by supplying in hardening agents, such as water or an oil, cooling quickly, and obtaining martensitic structure, after heating steel to austenitizing temperature. In this case, the temperature of the work piece fed into a hardening agent is abbreviation. Even when the boiling point of a hardening agent uses an oil for a hardening agent to being 850-degreeC It is about [ 250 degrees ] C. For this reason, a work piece will be covered with the steam film of a cooling agent until a hardening agent evaporates in an instant and a work piece is cooled to some extent. Since this steam film checks that a hardening agent can fall directly to a work piece, it makes the cooling rate of a work piece fall, and becomes the cause which produces dispersion in the quality of quenching. In order to solve this problem, the quenching equipment which has the structure for removing a steam film is used conventionally.

[0003] For example, the quenching equipment indicated by JP,8-311534,A forms the drop path of the work piece of the shape of a character of \*\* constituted combining a ramp inside a quenching tub, stretches a hardening agent to this quenching tub, and throws a work piece into it. According to this quenching equipment, a work piece falls to the quenching bottom of the tank section, colliding with said ramp while carrying out natural drop of the inside of a hardening agent. And a work piece is the impact which collides with a ramp, and a wrap steam film is removed for a work piece.

[0004] Moreover, the quenching equipment shown in drawing 5 aims at clearance of said steam film by making an injection style with the hardening agent stored in the quenching tub, and applying the injection style concerned to a work piece. As shown in drawing 5 , the axial flow pump 2 and the vent 3 containing a guide vane are formed in the quenching tub 1 of quenching equipment. Two or more arrangement is carried out with a position suitable in the tray 4 which consists of mesh plates etc., and a work piece is conveyed by the lifting device 5 in the predetermined quenching location shown by sign 4' the whole tray 4. Since the outlet of the vent 3 containing a guide vane is prepared towards predetermined quenching location 4', a work piece is placed into the injection style of the hardening agent which flows towards the upper part from a lower part, and a wrap steam film is compulsorily removed by the injection style

concerned in a work piece.

[0005] Furthermore, the horn for ultrasonic irradiation is prepared in a quenching tub, a work piece is vibrated by irradiating the supersonic wave which spreads a hardening agent at a work piece, and the quenching equipment from which a steam film is removed is also used.

[0006]

[Problem(s) to be Solved by the Invention] However, the quenching equipment of these former is holding the following troubles respectively. First, in the case of quenching equipment given in JP,8-311534,A, the technique of transforming the kinetic energy at the time of a work piece carrying out natural drop of the inside of a hardening agent into vibrational energy by making a work piece collide with a ramp is taken. therefore, the drop position of a work piece -- it was difficult for dispersion to arise in generating of vibrational energy depending on how, and to remove a steam film to homogeneity. Moreover, when a work piece collided with a path cam plate, there was also a possibility that a dent might be attached to a work piece.

[0007] Moreover, in the case of the quenching equipment shown in drawing 5 , since the injection direction of a hardening agent is limited to the upper part from the lower part of a quenching tub, although, as for the underside of the work piece arranged in a tray 4, clearance of a steam film is fully performed, about a top face, removing may become inadequate. For example, the difference becomes remarkable and quench distortion tends to generate disc-like work pieces, such as a gearing. Moreover, since the injection direction was a direction which intersects perpendicularly with a tray, in the center section of the tray, it was that it is easy to become inadequate removing [ of a steam film ]. For this reason, especially, when laying at a tray 4 in the case of a disc-like work piece, the face of a board needed to consider in the installation direction, such as making it perpendicularly suitable etc.

[0008] Furthermore, by irradiating a supersonic wave at a work piece, the droplet of the hardening agent generated from near the ultrasonic irradiation horn was emitted into air, and the quenching equipment from which a steam film is removed had fear, such as causing aggravation of work environment.

[0009] This invention is made in view of the above-mentioned technical problem, the place made into the object removes the steam film generated without causing aggravation of the work environment by the droplet of a hardening agent in case the heated work piece is fed into a hardening agent so that a work piece may be covered as soon as possible, and it is in performing quenching without dispersion.

[0010]

[Means for Solving the Problem] The quenching equipment concerning claim 1 of this invention for solving the above-mentioned technical problem is characterized by carrying a hardening agent and having an oscillating generating means to make the oscillatory wave of a direction which removes a wrap steam film for a work piece efficiently spread, to the work piece arranged in the predetermined location in a quenching tub.

[0011] In removing this steam film to homogeneity, since an oscillatory wave is made to spread in the direction which removes a wrap steam film for a work piece efficiently, in consideration of the position of a work piece, it is not necessary to arrange said oscillating generating means in the predetermined location in said quenching tub according to this invention.

[0012] Moreover, the quenching equipment concerning claim 2 of this invention sets vibration frequency of said oscillatory wave to ten to 120 Hz. Setting out of the

vibration frequency of the oscillatory wave which makes a hardening agent carry and spread like this invention does not emit the droplet of a hardening agent into air from said oscillating generating means.

[0013] Moreover, said vibration generator system makes the both-way oscillation of two or more wings aligned so that it might pile up within said quenching tub carry out in the alignment direction concerned in the quenching equipment concerning claim 3 of this invention. According to this configuration, said two or more wings vibrate in the direction in which the wing concerned aligns, a direct-quenching agent is scratched, and a hardening agent is made to generate transverse oscillation. Moreover, by having made it align so that each wing may be piled up, the vibration frequency of the oscillatory wave which each wing generates, phases, and all the oscillating directions are in agreement, and the oscillatory wave generated by each wing is not negated.

[0014] Furthermore, it is fixed to the oscillating shaft prolonged in the vertical direction within said quenching tub, and the quenching equipment concerning claim 4 of this invention drives said two or more wings with the vibrating motor by which the upper bed section of this oscillating shaft was fixed above the quenching tub. In this invention, a vibrating motor will be installed in a location higher than the reservoir level of the hardening agent stored by said quenching tub, and a vibrating motor is not asked for high sealing nature. Moreover, since said oscillating shaft is arranged so that it may hang from the vibrating motor concerned, it is not necessary to establish the hole which makes said oscillating shaft penetrate in the side face of a quenching tub, an underside, etc., and the sealing nature of said quenching tub itself is not checked with said oscillating shaft, either.

[0015]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained based on an accompanying drawing. Here, the same sign shows the same part as the conventional example, or a corresponding part, and detailed explanation is omitted.

[0016] The quenching equipment concerning the gestalt of operation of this invention is shown in drawing 1 . Moreover, the sectional view in A-A of drawing 1 is shown in drawing 2 . This quenching equipment is also equipped with the tray 4 which lays a work piece, and the lifting device 5 which makes it go up and down a tray 4 as well as the quenching equipment shown in drawing 5 . And when the minimum is determined by the stopper 6 and ramp 5a of a lifting device 5 is this minimum location, a tray 4 is arranged in the predetermined quenching location shown by sign 4'.

[0017] The work piece W laid in the tray 4 and the tray 4 is roughly shown in drawing 3 . A tray 4 has two or more shelf 4a, and shelf 4a and wall surface 4b consist of members to which hardening agents, such as a mesh plate, circulate freely. As a work piece W is accumulated on each shelf 4a of a tray 4 SU \*\*—SA S and by turns, it is laid in it. Although the work piece W of a graphic display shows disc-like things, such as a gearing, even if it is this case, it does not need to turn especially that face of a board in the direction of a vertical, and lays it horizontally like a graphic display. In addition, ramp 5a of a lifting device and a stopper 6 also consist of members to which hardening agents, such as a mesh plate, circulate freely. Moreover, a work piece W is in the condition laid in the tray 4, and is carried in and taken out by ramp 5a of a lifting device. The door which is not illustrated is prepared in the upper bed location of the rise-and-fall range of ramp 5a, and carrying in of a tray 4 and taking out are performed by opening this door.

[0018] Moreover, four (refer to drawing 2 ) surrounding predetermined quenching

location 4' are equipped with the oscillating generating means 7. This vibration generator system is expanded and shown in drawing 4. Here, structure explanation of the oscillating generating means 7 is given, referring to drawing 2 and drawing 4. A vibration generator system 7 is equipped with a vibrating motor 8 as a source of power. This vibrating motor 8 generates only the oscillation of the vertical direction by being in phase and carrying out counterrotation of the two eccentric waits. And power is supplied to a vibrating motor 8 through the transistor inverter (graphic display abbreviation) for controlling a frequency (ten to 120 Hz).

[0019] This vibrating motor 8 is fixed to the installation base 9, and by the guide shaft 11 set up to the pedestal 10, it is supporting so that the installation base 9 may become movable only in the vertical direction. Moreover, a coil spring 12 is inserted in the guide shaft 11, and the distance of the installation base 9 and a pedestal 10 is maintained by the elastic force. In addition, the installation base 9 may be supported by changing to a coil spring 12 and establishing a rubber bush etc. in the suitable location between the installation base 9 and a pedestal 10.

[0020] The oscillating shaft 13 which penetrates a pedestal 10 and is prolonged in the vertical direction is formed in the installation base 9. Between the oscillating shaft 13 and a pedestal 10, the seal 14 for securing sealing nature is formed, and the quenching tub 1 and atmospheric air are intercepted. And it is fixed to the oscillating shaft 13 so that two or more wings 15 (the example of a graphic display 15 sheets) may open fixed spacing and may lap mutually. In addition, since the male screw is formed in the oscillating shaft 13, two or more wings 15 are respectively fixed to the position of the oscillating shaft 13 with a nut 16. A wing 15 consists of a plate which has the flexibility of steel, stainless steel, titanium, etc., for example, is die length of 400mm, and width of face. The rectangle of 200mm and thickness 2.5 mm is made. Moreover, width of face The range of 70mm is raised at the include angle of about 10 degrees from ends up among 200mm. In addition, two oscillating shafts 13 are established at a time to one installation base 9, and each wing 15 is supported with two oscillating shafts 13, as shown in drawing 2.

[0021] An oscillating generating means 7 to have the above structure is being fixed above the quenching tub 1, as shown in drawing 1 R> 1. And each wing 15 is caudad located rather than the oil level 17 of the hardening agent filled by the quenching tub 1.

[0022] Now, the quenching equipment which makes the above-mentioned configuration removes a wrap steam film for a work piece as follows. First, if a vibrating motor 8 is operated, a vibrating motor 8 will vibrate up and down with the installation base 9, making a coil spring 12 expand and contract. Then, the oscillating shaft 13 fixed to the installation base 9 also vibrates up and down, and each wing 15 is vibrated up and down. Since a wing 15 has flexibility, it scratches a direct-quenching agent, bending like a fan in a hardening agent, and makes a hardening agent generate transverse oscillation. Since each wing 15 has aligned in the vertical direction so that it may lap mutually, the vibration frequency of the oscillatory wave which each wing 15 generates, phases, and all its oscillating directions correspond, and the oscillatory wave generated by each wing interferes in it, and it is not negated mutually.

[0023] And the oscillatory wave (ten to 120 Hz) generated in the hardening agent carries a hardening agent, and spreads it to predetermined quenching location 4'. Since this oscillatory wave centers on a lateral wave (it is not the oscillation of only the direction of a vertical but the wave of a three dimension at least.), the steam film of the vertical side of the work piece W horizontally laid on a tray 4 can be removed

.almost uniformly.

[0024] The operation effectiveness acquired from the gestalt of the operation of this invention which makes the above-mentioned configuration is as follows. First, since the oscillating generating means 7 scratches a hardening agent directly by two or more wings 15 and makes a hardening agent generate the oscillatory wave centering on a lateral wave, it can remove almost uniformly the steam film of the vertical side of the work piece W horizontally laid by predetermined quenching location 4'. Therefore, it becomes conventionally unnecessary like the disc-like work piece W considering [ which what needed to consider in the installation direction requires ]. Moreover, the direction of the disc-like work piece W in which the number which can usually be laid easily [ direction / installation ] laying on a tray horizontally is also laid horizontally increases. Therefore, according to the gestalt of this operation, it becomes possible to temper to the work piece W of at once more many numbers, preventing generating of quench distortion.

[0025] Moreover, the quenching equipment concerning the gestalt of this operation makes a hardening agent generate the oscillatory wave of the three dimension of ten to 120 Hz vibration frequency unlike the quenching equipment from which a steam film is removed with the conventional supersonic wave (20kHz above). In the range of the applied vibration frequency, the phenomenon of a hardening agent serving as a droplet of an ultrafine particle, and dispersing is not generated like [ at the time of using a supersonic wave ]. For this reason, a possibility of the droplet of a hardening agent not being emitted into air and causing aggravation of work environment also disappears.

[0026] Furthermore, since each wing 15 has aligned in the vertical direction so that it may lap mutually, the vibration frequency of the oscillatory wave which each wing 15 generates, phases, and all its oscillating directions correspond, and the oscillatory wave generated by each wing interferes in it, and it is not negated mutually. For this reason, an oscillatory wave can be certainly spread to predetermined quenching location 4', and can remove a wrap steam film for a work piece efficiently.

[0027] In addition, with the gestalt of this operation, since the vibrating motor 8 is installed in a location higher than the oil level 17 (reservoir level) of the hardening agent stored by the quenching tub 1, a vibrating motor 8 is not asked for high sealing nature. Moreover, since the location where the oscillating shaft 13 penetrates the quenching tub 1 is also located in a location higher than the oil level 17 of a hardening agent, it is not necessary to establish the hole which makes said oscillating shaft penetrate in the side face of the quenching tub 1, an underside, etc. for the oscillating shaft 13, and the sealing nature of quenching tub 1 the very thing is not checked with the oscillating shaft 1. Furthermore, since it is not directly fixed to the part of the lid of the quenching tub 1 but is fixed through the installation base 9, a coil spring 12, and a pedestal 10, a vibrating motor 8 can suppress generating of the nonconformity by an oscillation of a vibrating motor 8 getting across to the quenching tub 1 directly.

[0028] Moreover, as compared with motor 2a (refer to drawing 5 ) which drives the conventional axial flow pump 2, the power consumption of a vibrating motor 32 can have small power consumption, and it can also raise the profitability at the time of operation. For example, when the power consumption of motor 2a of the conventional axial flow pump is 2.2 kw/h, the power consumption of the vibrating motor 8 of the quenching equipment concerning the gestalt of the operation of this invention for acquiring equivalent steam film clearance capacity is stopped by 0.25 kw/h.

[0029] In addition, although the case where arranged a vibrating motor 8 and oscillating shaft 13 grade like the above, and a wing 15 was vibrated in the vertical direction in



the gestalt of operation of this invention was mentioned as the example and explained, it is also possible to constitute according to the work-piece configuration, the configuration of a tray, etc. of tempering by not being limit to this, so that a wing 15 may be vibrate in other various directions.

[0030]

[Effect of the Invention] Since this invention was constituted in this way, it has the following effectiveness. First, according to the quenching equipment concerning claim 1 of this invention, with conventional quenching equipment, starting consideration is made unnecessary also to the work piece which needed to consider in the direction of within a hardening agent, and it becomes possible to perform quenching without dispersion. Moreover, preventing generating of quench distortion, it can also become possible to temper to the work piece of at once more many numbers, and reduction of quenching cost can also be aimed at.

[0031] Moreover, according to the quenching equipment concerning claim 2 of this invention, it is possible it to be lost for that the droplet of a hardening agent is emitted into air, and to prevent aggravation of work environment.

[0032] Furthermore, according to the quenching equipment concerning claim 3 of this invention, even the work piece arranged certainly in the predetermined location in a quenching tub can spread an oscillatory wave, and it can remove a wrap steam film for a work piece efficiently.

[0033] In addition, since according to the quenching equipment concerning claim 4 of this invention said vibrating motor is not asked for high sealing nature and the sealing nature of said quenching tub itself is also maintained, it becomes possible to create quenching equipment by low cost.

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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1] It is the schematic diagram showing the quenching equipment concerning the gestalt of operation of this invention.

[Drawing 2] It is a sectional view in the A-A line of drawing 1 .

[Drawing 3] It is the \*\* type Fig. showing the tray which lays the work piece of the quenching equipment shown in drawing 1 .

[Drawing 4] It is the enlarged drawing showing only the oscillating generating means of the quenching equipment shown in drawing 1 .

[Drawing 5] It is the schematic diagram showing conventional quenching equipment.

[Description of Notations]

1 Quenching Tub

A 4' predetermined quenching location

7 Oscillating Generating Means

15 Wing

17 Oil Level of Hardening Agent

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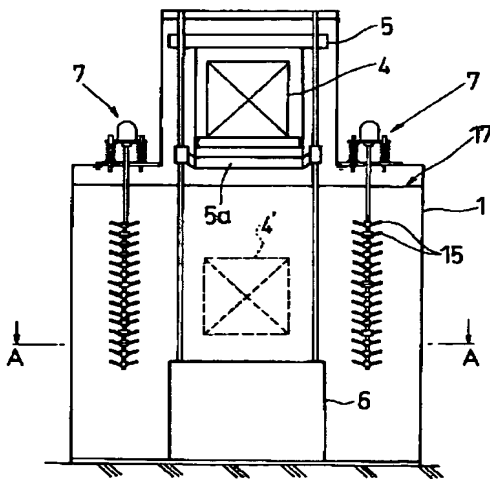
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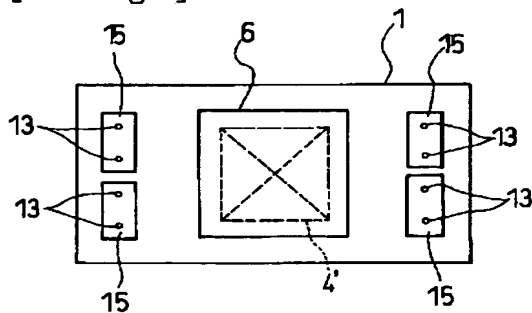
**DRAWINGS**

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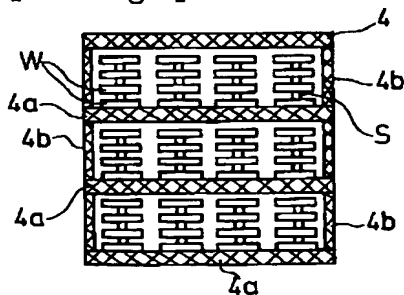
[Drawing 1]



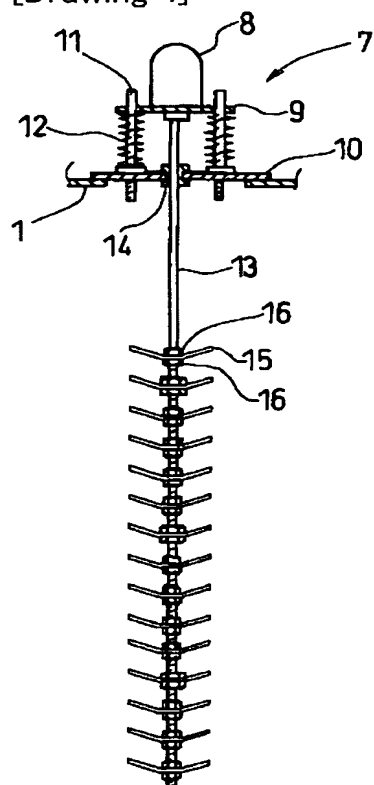
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Drawing 5]

